WHAT IS CLAIMED IS:

1. A method for decoding symbols transmitted in a multi-input multi-output communications system having M_t transmit antennas and M_r receive antennas, the symbols transmitted via a channel having an associated matrix **H** with M_t rows and M_r columns, the method comprising:

receiving a vector **r** of the transmitted symbols on the M_r receive antennas, wherein the vector **r** has M_r components;

thereafter forming a first vector quantity $\mathbf{xopt}_1$ associated with a first one of the transmit antennas and having elements defined by a column $\mathbf{h}_1$ of matrix **H** associated with the first antenna, the remaining columns $\mathbf{H}_{n\neq 1}$ of matrix **H**, and a matrix **X** of possible symbols transmitted on the remaining ones of the transmit antennas, wherein matrix **X** includes $(M_t\text{-}1)$ rows and 2^{u+n} columns, wherein each transmitted symbol is selected from 2^n cosets each having 2^u labels, wherein n and u each is an integer greater than zero;

thereafter finding a distance metric and a label metric associated with each of the remaining transmit antennas for each coset based on $\mathbf{xopt}_1$;

thereafter forming a second vector quantity $\mathbf{xopt}_2$ associated with a second one of the transmit antennas and having elements defined by a column $\mathbf{h}_2$ of matrix **H** associated with the second antenna, the remaining columns $\mathbf{H}_{n\neq 2}$ of matrix **H**, and the matrix **X**; and

thereafter finding a distance metric and a label metric associated with the first one of the transmit antennas for each coset based on $\mathbf{xopt}_2$.

2. The method of claim 1, wherein the first vector quantity $\mathbf{xopt}_1$ is defined by:

$$\mathbf{xopt}_1 = \left[\frac{\boldsymbol{\Lambda}^{-1}\left(\mathbf{h}_1^{*}\mathbf{r} - \mathbf{h}_1^{*}\mathbf{H}_{n\neq 1}\mathbf{X}\right)}{\mathbf{h}_1^{*}\mathbf{h}_1}\right]$$

wherein vector $\mathbf{h}_1^{*}$ is the complex conjugate transpose of vector $\mathbf{h}_1$, and $\boldsymbol{\Lambda}^{-1}$ is an auto-covariance matrix of any of the transmit antennas.

3. The method of claim 1, wherein the second vector quantity $\mathbf{xopt}_2$ is defined by:

$$\mathbf{xopt}_2 = \left[\frac{\Lambda^{-1}\left(\mathbf{h}_2^* \mathbf{r} - \mathbf{h}_2^* \mathbf{H}_{n\neq 2} \mathbf{X}\right)}{\mathbf{h}_2^* \mathbf{h}_2} \right]$$

wherein vector $\mathbf{h}_2^*$ is the complex conjugate transpose of vector $\mathbf{h}_2$ and Λ^{-1} is an auto-covariance matrix of any of the transmit antennas.

4. The method of claim 1, wherein for coset j, the distance metric associated with transmit antenna i is defined by:

$$d(i,j) = \min_k \left(\mathbf{r} - \mathbf{h}_1 \mathbf{xopt}_1(k) - \mathbf{H}_{n\neq 1}\mathbf{X}(k)\right)^H \Lambda^{-1}\left(\mathbf{r} - \mathbf{h}_1 \mathbf{xopt}_1(k) - \mathbf{H}_{n\neq 1}\mathbf{X}(k)\right)$$

wherein i represents one of the transmit antennas other than the first antenna, j represents one of the 2^n cosets, k represents one of the 2^u labels of coset j, $\mathbf{H}_{n\neq 1}$ is a matrix of the columns of $\mathbf{H}$ except the first column of matrix $\mathbf{H}$, Λ^{-1} is an auto-covariance matrix of any of the transmit antennas, $\mathbf{X}(k)$ represents all rows of matrix $\mathbf{X}$ which have an element of coset k in their i^{th} column, and $\mathbf{xopt}_1(k)$ represents those elements of vector $\mathbf{xopt}_1$ that belong to coset k.

5. The method of claim 1, wherein for coset j, the label metric associated with transmit antenna i is defined by:

$$label(i,j) = \arg\min_k \left(\mathbf{r} - \mathbf{h}_1 \mathbf{xopt}_1(k) - \mathbf{H}_{n\neq 1}\mathbf{X}(k)\right)^H \Lambda^{-1}\left(\mathbf{r} - \mathbf{h}_1 \mathbf{xopt}_1(\mathrm{k}) - \mathbf{H}_{n\neq 1}\mathbf{X}(k)\right)$$

wherein i represents one of the transmit antennas other than the first antenna, j represents one of the 2^n cosets, k represents one of the 2^u labels of coset j, $\mathbf{H}_{n\neq 1}$ is a matrix of the columns of $\mathbf{H}$ except the first column of matrix $\mathbf{H}$, Λ^{-1} is an auto-covariance matrix of any of the transmit antennas, $\mathbf{X}(k)$ represents all rows of matrix $\mathbf{X}$ which have an element of coset k in their i^{th} column, and $\mathbf{xopt}_1(k)$ represents those elements of vector $\mathbf{xopt}_1$ that belong to coset k.

6. The method of claim 1, wherein for coset j, the distance metric associated with the first one of the transmit antennas is defined by:

$$d(1,j) = \min_k \left(\mathbf{r} - \mathbf{h}_2\mathbf{xopt}_2(k) - \mathbf{H}_{n\neq 2}\mathbf{X}(k)\right)^H \Lambda^{-1}\left(\mathbf{r} - \mathbf{h}_2\mathbf{xopt}_2(k) - \mathbf{H}_{n\neq 2}\mathbf{X}(k)\right)$$

wherein j represents one of the 2^n cosets, k represents one of the 2^u labels of coset j, $\mathbf{h}_2$ is the second column of matrix **H**, $\mathbf{H}_{n\neq 2}$ is a matrix of the columns of **H** except the second column of matrix **H**, Λ^{-1} is an auto-covariance matrix of any of the transmit antennas, and $\mathbf{X}(k)$ represents all rows of matrix $\mathbf{X}$ which have an element of coset k in their 1st column.

7. The method of claim 1, wherein for coset j, the label metric associated with the first one of the transmit antennas is defined by:

$$label(1,j) = \arg\min_k \left(\mathbf{r} - \mathbf{h}_2\mathbf{xopt}_2(k) - \mathbf{H}_{n\neq 2}\mathbf{X}(k)\right)^H \Lambda^{-1}\left(\mathbf{r} - \mathbf{h}_2\mathbf{xopt}_2(\mathrm{k}) - \mathbf{H}_{n\neq 2}\mathbf{X}(k)\right)$$

wherein j represents one of the 2^n cosets, k represents one of the 2^u labels of coset j, $\mathbf{h}_2$ is the second column of matrix **H**, $\mathbf{H}_{n\neq 2}$ is a matrix of the columns of **H** except the second column of matrix **H**, Λ^{-1} is an auto-covariance matrix of any of the transmit antennas, and $\mathbf{X}(k)$ represents all rows of matrix $\mathbf{X}$ which have an element of coset k in their 1st column.

8. The method of claim 7, further comprising:

applying the distance metric and the label metric associated with each transmit antenna to a Viterbi decoder.

9. The method of claim 8, further comprising:

applying the distance metric and the label metric associated with the first transmit antenna to each of the i^{th} to M_t^{th} transitions in the trellis, wherein i is an integer varying from 0 to (M_t-1).

10. A decoder adapted to receive a vector **r** of symbols transmitted in a multi-input multi-output communications system having M_t transmit antennas and M_r receive antennas, said decoder further adapted to receive a channel matrix **H** having M_t rows and M_r columns and through which the symbols are transmitted, wherein the vector **r** has M_r components, the decoder comprising:

a first module adapted to form a first vector quantity $\mathbf{xopt}_1$ associated with a first one of the transmit antennas and having elements defined by a column $\mathbf{h}_1$ of matrix **H**

associated with the first antenna, the remaining columns $\mathbf{H}_{n\neq 1}$ of matrix **H**, and a matrix **X** of possible symbols transmitted on the remaining ones of the transmit antennas, wherein matrix **X** includes (M_t-1) rows and 2^{u+n} columns, wherein each transmitted symbol is selected from 2^n cosets each having 2^u labels, wherein n and u each is an integer greater than zero;

a second module adapted to compute a distance metric and a label metric associated with each of the remaining transmit antennas for each coset based on $\mathbf{xopt}_1$;

a third module adapted to form a second vector quantity $\mathbf{xopt}_2$ associated with a second one of the transmit antennas and having elements defined by a column $\mathbf{h}_2$ of matrix **H** associated with the second antenna, the remaining columns $\mathbf{H}_{n\neq 2}$ of matrix **H**, and the matrix **X**; and

a fourth module adapted to compute a distance metric and a label metric associated with the first one of the transmit antennas for each coset based on $\mathbf{xopt}_2$.

11. The decoder of claim 10, wherein said first vector quantity $\mathbf{xopt}_1$ formed by said first module is defined by:

$$\mathbf{xopt}_1 = \left[\frac{\Lambda^{-1}\left(\mathbf{h}_1^{*}\mathbf{r} - \mathbf{h}_1^{*}\mathbf{H}_{n\neq 1}\mathbf{X}\right)}{\mathbf{h}_1^{*}\mathbf{h}_1}\right]$$

wherein vector $\mathbf{h}_1^{*}$ is the complex conjugate transpose of vector $\mathbf{h}_1$, and Λ^{-1} is an auto-covariance matrix of any of the transmit antennas.

12. The decoder of claim 10, wherein said second vector quantity $\mathbf{xopt}_2$ formed by said third module is defined by:

$$\mathbf{xopt}_2 = \left[\frac{\Lambda^{-1}\left(\mathbf{h}_2^{*}\mathbf{r} - \mathbf{h}_2^{*}\mathbf{H}_{n\neq 2}\mathbf{X}\right)}{\mathbf{h}_2^{*}\mathbf{h}_2}\right]$$

wherein vector $\mathbf{h}_2^{*}$ is the complex conjugate transpose of vector $\mathbf{h}_2$ and Λ^{-1} is an auto-covariance matrix of any of the transmit antennas.

13. The decoder of claim 10, wherein for coset j, the distance metric computed by the second module and associated with transmit antenna i is defined by:

$$d(i,j) = \min_k \left(\mathbf{r} - \mathbf{h}_1 \mathbf{xopt}_1(k) - \mathbf{H}_{n\neq 1}\mathbf{X}(k)\right)^{\prime\prime} \boldsymbol{\Lambda}^{-1}\left(\mathbf{r} - \mathbf{h}_1 \mathbf{xopt}_1(k) - \mathbf{H}_{n\neq 1}\mathbf{X}(k)\right)$$

wherein i represents one of the transmit antennas other than the first antenna, j represents one of the 2^n cosets, k represents one of the 2^u labels of coset j, $\mathbf{H}_{n\neq 1}$ is a matrix of the columns of **H** except the first column of matrix **H**, $\boldsymbol{\Lambda}^{-1}$ is an auto-covariance matrix of any of the transmit antennas, $\mathbf{X}(k)$ represents all rows of matrix $\mathbf{X}$ which have an element of coset k in their i^{th} column, and $\mathbf{xopt}_1(k)$ represents those elements of vector $\mathbf{xopt}_1$ that belong to coset k.

14. The decoder of claim 10, wherein for coset j, the label metric computed by the second module and associated with transmit antenna i is defined by:

$$label(i,j) = \arg\min_k \left(\mathbf{r} - \mathbf{h}_1 \mathbf{xopt}_1(k) - \mathbf{H}_{n\neq 1}\mathbf{X}(k)\right)^{\prime\prime} \boldsymbol{\Lambda}^{-1}\left(\mathbf{r} - \mathbf{h}_1 \mathbf{xopt}_1(\mathrm{k}) - \mathbf{H}_{n\neq 1}\mathbf{X}(k)\right)$$

wherein i represents one of the transmit antennas other than the first antenna, j represents one of the 2^n cosets, k represents one of the 2^u labels of coset j, $\mathbf{H}_{n\neq 1}$ is a matrix of the columns of **H** except the first column of matrix **H**, $\boldsymbol{\Lambda}^{-1}$ is an auto-covariance matrix of any of the transmit antennas, $\mathbf{X}(k)$ represents all rows of matrix $\mathbf{X}$ which have an element of coset k in their i^{th} column, and $\mathbf{xopt}_1(k)$ represents those elements of vector $\mathbf{xopt}_1$ that belong to coset k.

15. The decoder of claim 10, wherein for coset j, the distance metric computed by the fourth module and associated with the first one of the transmit antennas is defined by:

$$d(1,j) = \min_k \left(\mathbf{r} - \mathbf{h}_2 \mathbf{xopt}_2(k) - \mathbf{H}_{n\neq 2}\mathbf{X}(k)\right)^{\prime\prime} \boldsymbol{\Lambda}^{-1}\left(\mathbf{r} - \mathbf{h}_2 \mathbf{xopt}_2(k) - \mathbf{H}_{n\neq 2}\mathbf{X}(k)\right)$$

wherein j represents one of the 2^n cosets, k represents one of the 2^u labels of coset j, $\mathbf{h}_2$ is the second column of matrix **H**, $\mathbf{H}_{n\neq 2}$ is a matrix of the columns of **H** except the second column of matrix **H**, $\boldsymbol{\Lambda}^{-1}$ is an auto-covariance matrix of any of the transmit antennas, and $\mathbf{X}(k)$ represents all rows of matrix $\mathbf{X}$ which have an element of coset k in their 1^{st} column.

16. The decoder of claim 12, wherein for coset j, the label computed by the fourth module and associated with the first one of the transmit antenna is defined by:

$$label(1,j) = \arg\min_{k} \left(\mathbf{r} - \mathbf{h}_2\mathbf{xopt}_2(k) - \mathbf{H}_{n\neq 2}\mathbf{X}(k)\right)^H \boldsymbol{\Lambda}^{-1}\left(\mathbf{r} - \mathbf{h}_2\mathbf{xopt}_2(\mathrm{k}) - \mathbf{H}_{n\neq 2}\mathbf{X}(k)\right)$$

wherein j represents one of the 2^n cosets, k represents one of the 2^u labels of coset j, $\mathbf{h}_2$ is the second column of matrix **H**, $\mathbf{H}_{n\neq 2}$ is a matrix of the columns of **H** except the second column of matrix **H**, $\boldsymbol{\Lambda}^{-1}$ is an auto-covariance matrix of any of the transmit antennas, and $\mathbf{X}(k)$ represents all rows of matrix $\mathbf{X}$ which have an element of coset k in their 1^{st} column.

17. The decoder of claim 16, wherein said decoder supplies the distance metric and the label metric associated with each transmit antenna to a Viterbi decoder.

18. The decoder of claim 10, wherein each of the first, second, third and fourth modules is a software module

19. The decoder of claim 10, wherein each of the first, second, third and fourth modules is a hardware module.

20. The decoder of claim 10, wherein each of the first, second, third and fourth modules includes both software and hardware modules.